(1)

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(1-1)

[Claim 3]

A method of synthesizing diamond according to claim 1, which comprises using an introduced gas containing at least carbon (C), hydrogen (H) and nitrogen (N) to epitaxially grow a single crystal of diamond from the gaseous phase, characterized in that a main surface for growth is a {100} surface or a surface with misorientation within 10° with respect to {100}.

(1-2)

[Claim 4]

A method for synthesizing diamond according to claim 1, which comprises using an introduced gas containing at least carbon (C), hydrogen (H) and nitrogen (N) to epitaxially grow a single crystal of diamond from the gaseous phase, characterized in that a main surface for growth is a {111} surface or a surface with misorientation within 10° with respect to {111}.

(1-3)

[0018]

When the amount of nitrogen introduced is not lower than 3 ppm in terms of a ratio of the number of nitrogen atoms to the number of hydrogen atoms, the effect of an increase in film formation rate starts to appear. When it is not lower than 30 ppm, a film formation rate significantly increases. The significant deterioration of film quality other than nitrogen contamination is not observed at this ratio of at least 300 ppm and less than 1000 ppm. Amorphous components start to grow at the ratio exceeding 1000 ppm. Thus, the ratio is preferably in the range of 3 ppm to 1000 ppm, more preferably not lower than 30 ppm to not higher than 300 ppm.

(1-4)

[0019]

Nitrogen of not lower than 30 ppm to not higher than 300 ppm is preferable for use in optical applications in the infrared region, because the absorption of nitrogen of not higher than 300 ppm is not observed. Nitrogen of not higher than 80 ppm is preferable for use in applications in the ultraviolet to visible regions, because a trace amount of nitrogen brings about absorption in these regions as compared with in the infrared region.

(1-5)

[0028]

(Example 6) A 3 mm×3 mm artificial Ib single crystal diamond substrate of 0.5 mm in thickness was prepared. The deviation in plane orientation from {100} was within 1°. Diamond was grown on this substrate by the microwave plasma CVD method. An introduced gas contained 3 sccm of methane, 1 sccm of oxygen, 85 sccm of hydrogen, and 15 sccm of ammonia diluted at 1000 ppm in the hydrogen. Diamond was grown at a substrate temperature of 1100°C and a pressure of 100 torr for a film formation time of 400 hours. After growth, the thickness of the formed film was examined, demonstrating that the film grew into 3.2 mm in thickness.

[0029]

The growth surface of the grown diamond was mirror-polished. The substrate diamond was further removed by excimer laser processing, and the resulting surface was mirror-polished. The film was visually observed to be transparent except that it assumed a slightly yellow color. Absorption by substitutional nitrogen was slightly observed in the measurement of the light transmission characteristics of the film. 1 ppm nitrogen was detected by SIMS (secondary ion mass spectrometry). The half-width of (400) reflection, which was measured by double-crystal X-ray diffraction, was 40 seconds, demonstrating that it was an excellent crystal.